Correlation of single photon emission CT with MR image data using fiduciary markers.

1. B J Erickson and
2. C R Jack Jr

+ Author Affiliations

1. Department of Radiology, Mayo Clinic, Rochester, MN 55905.

Abstract

PURPOSE To describe our approach to mapping the functional information provided by single photon emission computed tomography (SPECT) onto the anatomic template provided by MR, and to determine both the number of markers required to achieve accuracy and the impact of voxel shape on accuracy.

METHODS Point-to-point iterative minimization using externally fixed fiducial markers was involved and computer simulations were performed. Two types of validation studies were performed using a phanton using a phantom of known dimensions. First, the spatial distortion that may be present in MR was investigated for spin-echo and gradient-recalled echo images. Next, the accuracy with which the SPECT image could be transformed to match the MR template was analyzed. The method is also demonstrated in four cases of patients with epilepsy.

RESULTS Computer simulations indicated that for voxel dimensions we expected to use, eight fiduciary markers would consistently produce acceptable accuracy. Simulations also showed that more isotropic voxels would be more accurate if voxel volume is held constant. The spatial accuracy of both spin-echo and gradient-recalled echo images of a phantom was accurate to within 3 mm. When the SPECT image of the same phantom was correlated with the MR image using this technique, internal marker errors were never greater than 3 mm, and the mean error was 2.2 mm.

CONCLUSIONS Images from different modalities can be accurately correlated using multiple fiduciary markers. SPECT and MR images of the given dimensions can be correlated to within 3 mm. The technique aids in clarification of the nature of SPECT perfusion abnormalities and in their anatomic localization.